



west virginia department of environmental protection

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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Registration No.:	R13-2929
Plant ID No.:	017-00035
Applicant:	MarkWest Liberty Midstream & Resources, LLC
Facility Name:	Midpoint Compressor Station
Location:	New Milton, Doddridge County
NAICS Code:	211111
Application Type:	Construction
Received Date:	April 17, 2012
Engineer Assigned:	Roy F. Kees, P.E.
Fee Amount:	\$2,000.00
Date Received:	April 17, 2012
Complete Date:	May 18, 2012
Due Date:	August 18, 2012
Applicant Ad Date:	April 17, 2012
Newspaper:	<i>The Herald Record</i>
UTM's:	Easting: 527.416 km Northing: 4339.327 km Zone: 17
Description:	Application to construct a natural gas compressor station consisting of (6) compressor engines, (1) generator, (5) condensate tanks, and (1) dehy with flare.

TYPE OF PROCESS

Taken from registration application R13-2929:

The Midpoint Compressor Station will be capable of gathering and compressing up to 120 mmscf/day of natural gas. Proposed emission sources for the processing facility include six (6) 2,370 hp natural gas-fired Caterpillar G3608 compressor engines, each equipped with an oxidation catalyst, one (1) 276 hp John Deere 6068HF285 diesel generator set equipped with an oxidation catalyst, five (5) storage tanks including one (1) 500 bbl gunbarrel tank and four (4) 400 bbl tanks for condensate/water controlled with a VRU, and a TEG dehydration unit controlled with a flare and including a 2.0 mmbtu/hr reboiler. The station will also have (1) 300 gallon diesel tank, (2) 1000 gallon lube oil tanks, (1) 1000 gallon used oil tank, (1) 500 gallon TEG tank and (2) 500 gallon methanol tanks; all of which will be non-vented.

The Midpoint Compressor Station will be used to gather gas from surrounding wells, to compress and dehydrate the gas, and to move the gas down the pipeline for distribution or processing at a natural gas processing plant. It should be noted that MarkWest does not own or operate any gas wells. MarkWest does own and operate the Sherwood Gas Plant, a processing facility which is undergoing construction permit review, but which is located 4.7 miles away from the Midpoint Station. Therefore, aggregation of the Midpoint Compressor Station with any other sources is not appropriate.

SITE INSPECTION

A site inspection was performed by Jamie Jarrett of the enforcement section on May 22, 2012. The site was very isolated and some work had been performed on the land but there was no equipment present. Directions as given in the permit application are as follows:

From intersection of State Highway 18 and Co Route 25, head west/south on C/R 25 (3.3 miles). Turn right on Brushy Fork Road C/R 56 (0.6 miles). Turn right and follow to Midpoint Station (0.5 miles).

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Maximum controlled point source emissions for the Midpoint Compressor Station, provided by MarkWest and checked for accuracy by the writer, are summarized in the table below. Emissions from the six Caterpillar G3608 natural gas-fired compressor engines and one John Deere 6068HF285 diesel-fired emergency generator were calculated using engine & catalyst manufacturer data as well as AP-42 and fuel usage rate. The John Deere generator's emissions are based on 500 hours of operation per year while the compressor engines are based on 8,760 hours per year. Emissions from the dehydration unit and flare were calculated by GlyCalc 4.0. Emissions from the reboiler were calculated using AP-42 based on 8,760 hours per year. Emissions from the (4) 400 bbl and (1) 500 bbl condensate tanks were estimated together using Aspen HYSYS Version 7.1 based on a annual total throughput of 22,874.3 bbl/day. This is broken down into 51.5 bbl/day for the Spring/Fall (183 days) and 147.8 days for the Winter (91 days) and 0 bbl/day for the Summer (91 days). All condensate tank emissions are controlled by a Vapor Recovery Unit assuming a 98% control efficiency.

Source ID	Emission Source	Pollutant	Maximum Hourly Emissions (lb/hr)	Maximum Annual Emissions (tpy)
CM-1001	Caterpillar G3608LE Compressor Engine	Nitrogen Oxides	2.61	11.44
		Carbon Monoxide	0.73	3.20
		Volatile Organic Compounds	1.78	7.78
		Sulfur Dioxide	0.01	0.05
		Particulate Matter – 10	0.18	0.78

		Formaldehyde	0.16	0.69
		CO ₂ e	----	8306.38
CM-1002	Caterpillar G3608LE Compressor Engine	Nitrogen Oxides	2.61	11.44
		Carbon Monoxide	0.73	3.20
		Volatile Organic Compounds	1.78	7.78
		Sulfur Dioxide	0.01	0.05
		Particulate Matter – 10	0.18	0.78
		Formaldehyde	0.16	0.69
		CO ₂ e	----	8306.38
CM-1003	Caterpillar G3608LE Compressor Engine	Nitrogen Oxides	2.61	11.44
		Carbon Monoxide	0.73	3.20
		Volatile Organic Compounds	1.78	7.78
		Sulfur Dioxide	0.01	0.05
		Particulate Matter – 10	0.18	0.78
		Formaldehyde	0.16	0.69
		CO ₂ e	----	8306.38
CM-1004	Caterpillar G3608LE Compressor Engine	Nitrogen Oxides	2.61	11.44
		Carbon Monoxide	0.73	3.20
		Volatile Organic Compounds	1.78	7.78
		Sulfur Dioxide	0.01	0.05
		Particulate Matter – 10	0.18	0.78
		Formaldehyde	0.16	0.69
		CO ₂ e	----	8306.38
CM-1005	Caterpillar G3608LE Compressor Engine	Nitrogen Oxides	2.61	11.44
		Carbon Monoxide	0.73	3.20
		Volatile Organic Compounds	1.78	7.78
		Sulfur Dioxide	0.01	0.05
		Particulate Matter – 10	0.18	0.78
		Formaldehyde	0.16	0.69
		CO ₂ e	----	8306.38
CM-1006	Caterpillar G3608LE Compressor Engine	Nitrogen Oxides	2.61	11.44
		Carbon Monoxide	0.73	3.20
		Volatile Organic Compounds	1.78	7.78
		Sulfur Dioxide	0.01	0.05
		Particulate Matter – 10	0.18	0.78
		Formaldehyde	0.16	0.69
		CO ₂ e	----	8306.38
G-1001	John Deere 6068HF285 Emergency Generator (Diesel)	Nitrogen Oxides	0.54	2.37
		Carbon Monoxide	0.90	3.95
		Volatile Organic Compounds	0.16	0.71
		Sulfur Dioxide	<0.01	0.01
		Particulate Matter – 10	0.03	0.12
		Formaldehyde	0.14	0.63
		CO ₂ e	----	623.86
	Glycol	Nitrogen Oxides	0.17	0.73

RBV-1	Dehydrator Reboiler	Carbon Monoxide	0.14	0.61
		Volatile Organic Compounds	<0.01	0.04
		Particulate Matter-10	0.01	0.06
		CO ₂ e	----	1057.40
RSV-1 FL-991	Glycol Dehydrator Still Vent And Flare	Nitrogen Oxides	0.58	2.56
		Carbon Monoxide	0.49	2.15
		Volatile Organic Compounds	2.05	8.98
		Benzene	0.03	0.15
		Toluene	0.12	0.54
		Xylenes	0.07	0.30
		n-Hexane	0.09	0.38
		CO ₂ e	----	175.99
T01-T05	Condensate Tanks	Total VOC	3.56	8.80
		Total HAPs	0.27	0.86
		CO ₂ e	----	65.56

Proposed Facility Totals Are:

Pollutant	Hourly Emissions (lb/hr)	Annual Emissions (tons/year)
Nitrogen Oxides	16.97	74.31
Carbon Monoxide	5.92	25.93
Volatile Organic Compounds	16.44	65.21
Sulfur Dioxide	0.07	0.30
Particulate Matter – 10	1.15	5.04
Formaldehyde	1.08	4.75
Benzene	0.08	0.36
Ethylbenzene	<0.01	0.02
Toluene	0.17	0.74
Xylenes	0.09	0.39
n-Hexane	0.48	1.77
CO ₂ e	----	51,761.08
Total HAPs	3.78	16.24

REGULATORY APPLICABILITY

45CSR2 (Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers)

MarkWest is subject to the opacity requirements in 45CSR2 because of the reboiler RBV-1, which is 10% opacity based on a six minute block average. Compliance with the visible emission requirements shall be determined in accordance with 40 CFR Part 60, Appendix A, Method 22. Since this is a natural gas-fired source, quarterly tests will suffice.

45CSR4 (To Prevent and Control the Discharge of Air Pollutants into the Open Air which Causes or Contributes to an Objectionable Odor or Odors)

45CSR4 states that an objectionable odor is an odor that is deemed objectionable when in the opinion of a duly authorized representative of the Air Pollution Control Commission (Division of Air Quality), based upon their investigations and complaints, such odor is objectionable. No odors have been deemed objectionable.

45CSR13 (Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation)

45CSR13 applies to this source due to the fact that MarkWest exceeds the regulatory emission threshold for criteria pollutants of 6 lb/hr and 10 ton/year and the substantive requirements of 40CFR60 Subparts IIII & JJJJ. MarkWest paid the \$1000 application fee and \$1000 NSPS fee. MarkWest also placed the required legal ad in *The Herald Record* on April 17, 2012 for which the affidavit of publication was received on May 1, 2012. Then after a site inspection, the application was deemed complete on May 18, 2012.

45CSR14 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants)

As shown in the table below, MarkWest is not subject to 45CSR14 review.

Pollutant	PSD (45CSR14) Threshold (tpy)	Midpoint PTE (tpy)	45CSR14 Review Required?
Carbon Dioxide	100,000	51,761.08	No
Carbon Monoxide	250	25.93	No
Nitrogen Oxides	250	74.31	No
Sulfur Dioxide	250	0.30	No
Ozone (VOC)	250	65.21	No
Particulate Matter (TSP, PM10, PM2.5)	250	5.04	No

45CSR22 (Air Quality Management Fee Program)

This rule establishes a program to collect fees for certificates to operate and for permits to construct, modify or relocate sources of air pollution. Funds collected from these fees will be used to supplement the Director's budget for the purpose of maintaining an effective air quality management program. The facility will demonstrate compliance

with this rule by obtaining a Certificate to Operate (CTO) and paying annual fees in order to maintain a current CTO. MarkWest is subject to this rule because they are a minor source not subject to 45CSR30. MarkWest is subject to two NSPS, 40CFR60 Subparts IIII & JJJJ, but these are exempt from 45CSR30. This compressor station has engines greater than 1000 horsepower, therefore it falls into fee code 8D.

40CFR60 Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines)

40CFR60 Subpart JJJJ sets forth emission limits, fuel requirements, installation requirements, and monitoring requirements based on the year of installation of the subject internal combustion engine. 40CFR60 Subpart JJJJ is applicable to owners and operators of new stationary spark ignition internal combustion engines manufactured or overhauled after July 1, 2007 and with a maximum rated power capacity greater than 500 hp and fired by natural gas.

Based on the manufacturer's specifications for the six 2,370 hp Caterpillar G3608LE engines, the emission standards will be met. Because the engine is not certified by the manufacturer, MarkWest will demonstrate compliance by conducting initial and subsequent performance testing as required by Subpart JJJJ. MarkWest will also be required to maintain a maintenance plan and associated records.

40CFR60 Subpart IIII (Standards of Performance for Stationary Compression Ignition Internal Combustion Engines, Emergency Generator G-1001 only)

40CFR60 Subpart IIII sets forth emission limits, fuel requirements, installation requirements, and monitoring requirements based on the year of installation of the subject internal combustion engine. 40CFR60 Subpart IIII is applicable to owners and operators of new stationary compression ignition internal combustion engines manufactured or overhauled after 2007 and with a displacement less than 30 liters per cylinder and fired by diesel fuel.

Based on the manufacturer's specifications for the 276 hp John Deere 6068HF285 emergency generator, the emission standards will be met. Because the engine is certified by the manufacturer, no performance testing will be required.

WVDEP DAQ did not determine whether the applicant is subject to an area source air toxics standard requiring Generally Achievable Control Technology (GACT) promulgated after January 1, 2007 pursuant to 40 CFR 63, including the area source air toxics provisions of 40 CFR 63, Subpart HH and 40 CFR 63, Subpart ZZZZ.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

The following information was obtained from USEPA's Air Toxic Website.

Hexane

Hexane is used to extract edible oils from seeds and vegetables, as a special-use solvent, and as a cleaning agent. Acute (short-term) inhalation exposure of humans to high levels of hexane causes mild central nervous system (CNS) effects, including dizziness, giddiness, slight nausea, and headache. Chronic (long-term) exposure to hexane in air is associated with polyneuropathy in humans, with numbness in the extremities, muscular weakness, blurred vision, headache, and fatigue observed. Neurotoxic effects have also been exhibited in rats. No information is available on the carcinogenic effects of hexane in humans or animals. EPA has classified hexane as a Group D, not classifiable as to human carcinogenicity.

Benzene

Benzene is found in the air from emissions from burning coal and oil, gasoline service stations, and motor vehicle exhaust. Acute (short-term) inhalation exposure of humans to benzene may cause drowsiness, dizziness, headaches, as well as eye, skin, and respiratory tract irritation, and, at high levels, unconsciousness. Chronic (long-term) inhalation exposure has caused various disorders in the blood, including reduced numbers of red blood cells and aplastic anemia, in occupational settings. Reproductive effects have been reported for women exposed by inhalation to high levels, and adverse effects on the developing fetus have been observed in animal tests. Increased incidence of leukemia (cancer of the tissues that form white blood cells) have been observed in humans occupationally exposed to benzene. EPA has classified benzene as a Group A, human carcinogen.

Ethylbenzene

Ethylbenzene is mainly used in the manufacture of styrene. Acute (short-term) exposure to ethylbenzene in humans results in respiratory effects, such as throat irritation and chest constriction, irritation of the eyes, and neurological effects such as dizziness. Chronic (long-term) exposure to ethylbenzene by inhalation in humans has shown conflicting results regarding its effects on the blood. Animal studies have reported effects on the blood, liver, and kidneys from chronic inhalation exposure to ethylbenzene. Limited information is available on the carcinogenic effects of ethylbenzene in humans. In a study by the National Toxicology Program (NTP), exposure to ethylbenzene by inhalation resulted in an increased incidence of kidney and testicular tumors in rats, and lung and liver tumors in mice. EPA has classified ethylbenzene as a Group D, not classifiable as to human carcinogenicity.

Toluene

Toluene is added to gasoline, used to produce benzene, and used as a solvent. Exposed to toluene may occur from breathing ambient or indoor air. The central nervous system (CNS) is the primary target organ for toluene toxicity in both humans and animals for acute (short-term) and chronic (long-term) exposures. CNS dysfunction and narcosis have been frequently observed in humans acutely exposed to toluene by inhalation; symptoms include fatigue, sleepiness,

headaches, and nausea. CNS depression has been reported to occur in chronic abusers exposed to high levels of toluene. Chronic inhalation exposure of humans to toluene also causes irritation of the upper respiratory tract and eyes, sore throat, dizziness, and headache. Human studies have reported developmental effects, such as CNS dysfunction, attention deficits, and minor craniofacial and limb anomalies, in the children of pregnant women exposed to toluene or mixed solvents by inhalation. Reproductive effects, including an association between exposure to toluene and an increased incidence of spontaneous abortions, have also been noted. However, these studies are not conclusive due to many confounding variables. EPA has classified toluene as a Group D, not classifiable as to human carcinogenicity.

Xylene

Commercial or mixed xylene usually contains about 40-65% m-xylene and up to 20% each of o-xylene and p-xylene and ethylbenzene. Xylenes are released into the atmosphere as fugitive emissions from industrial sources, from auto exhaust, and through volatilization from their use as solvents. Acute (short-term) inhalation exposure to mixed xylenes in humans results in irritation of the eyes, nose, and throat, gastrointestinal effects, eye irritation, and neurological effects. Chronic (long-term) inhalation exposure of humans to mixed xylenes results primarily in central nervous system (CNS) effects, such as headache, dizziness, fatigue, tremors, and incoordination; respiratory, cardiovascular, and kidney effects have also been reported. EPA has classified mixed xylenes as a Group D, not classifiable as to human carcinogenicity.

AIR QUALITY IMPACT ANALYSIS

Modeling was not required of this source since the facility is not subject to 45CSR14 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants) as seen in the table listed in the Regulatory Applicability Section.

MONITORING OF OPERATIONS

MarkWest will be required to perform the following monitoring:

1. Monitor and record quantity of natural gas and diesel consumed for all engines and reboilers.
2. Monitor and record the wet gas throughput of the dehydration units.
3. Monitor and record the total throughput of tanks T01-T05.
4. Monitor the capture efficiency of the Vapor Recovery Unit.

MarkWest will be required to perform the following recordkeeping:

1. Maintain records of the amount of natural gas consumed in CM-1001-1006 and diesel consumed in G-1001.

2. Maintain records of testing conducted in accordance with the permit. Said records shall be maintained on-site or in a readily accessible off-site location
3. Maintain the corresponding records specified by the on-going monitoring requirements of and testing requirements of the permit.
4. Maintain records of the visible emission opacity tests conducted per the permit.
5. Maintain a record of all potential to emit (PTE) HAP calculations for the entire facility. These records shall include the natural gas compressor engines and ancillary equipment.
6. The records shall be maintained on site or in a readily available off-site location maintained by MarkWest for a period of five (5) years.
7. Maintain a record of total throughput of Tanks T01-T05.
8. Maintain a record of Vapor Recovery Unit monitoring.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that MarkWest should meet all applicable requirements of any state rules and federal regulations. Therefore, it is recommended that the natural gas compressor station to be located near New Milton in Doddridge County be granted a 45CSR13 construction permit for their facility.

Roy F. Kees, P.E.
Engineer – NSR Permitting

Date